

IE 443: Multiobjective Decision Analysis

Homework Assignment 2

Fall 2021

Due: November 4, 2021 - 11.59 pm

NOTE: Please, e-mail your homeworks to your teaching assistant Ege-men Elver (egemen.elver@bilkent.edu.tr). For the figures that you are asked to draw, be sure to provide a complete figure in the sense that the names of the axes, the coordinates of important points etc. are indicated. You may use a software of your choice in order to draw the figures if you think this would be easier but you are not required to do that.

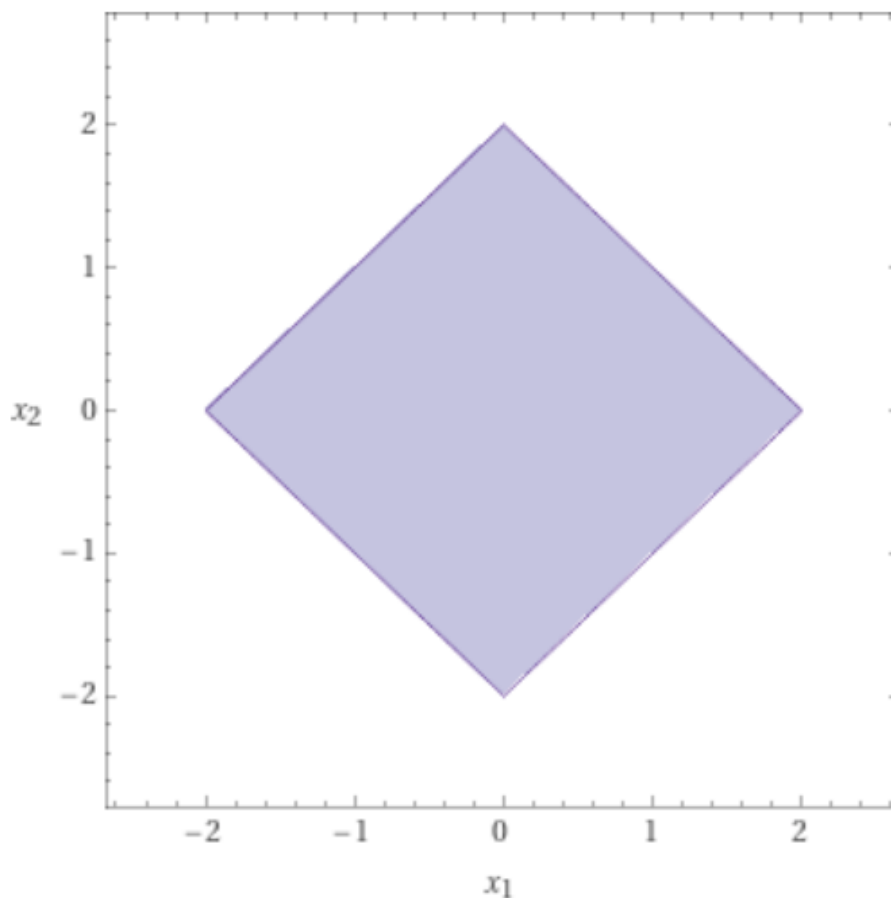
Question 1. Consider the following linear multiobjective optimization problem:

$$\begin{aligned} & \text{minimize} && [f_1(x), f_2(x)] \\ & \text{subject to} && x_1 + x_2 \leq 4 \\ & && -x_1 + x_2 \leq 2 \\ & && -1 \leq x_1 \leq 2 \\ & && -1 \leq x_2 \leq 3, \end{aligned}$$

where $f_1(x) = 2x_1 + x_2$ and $f_2(x) = x_2 - x_1$.

- (a) Draw the feasible region and the image of the feasible region.
- (b) Find the efficient set and the non-dominated set. Show your work.
- (c) Find the ideal point (y^I) and the nadir point (y^N).

Question 2. One obtains the following feasible region of a multiobjective optimization problem with the objective function: $\min\{x_1, x_2\}$



- (a) Draw the image of the feasible region. Determine the non-dominated points.
- (b) Are there any unsupported non-dominated points? Explain.

Question 3. Read the article *A Preference Ranking Organisation Method* (Brans and Vincke, 1985). Remember the Question 2 in Homework 1 with 3 criteria and 5 nondominated options (Options 1,2,4,6 and 8). Provide a full ranking for these nondominated options applying the method described in the article. Show your work.